

Health Consultation

Technical Document Review
Draft Phase II Hydrogeologic Investigation
Y-Road Landfills
Whatcom County, Washington

March 25, 2002

Prepared by

**The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of a health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond quickly to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

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Glossary

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| Acute | Occurring over a short period of time. An acute exposure is one which lasts for less than 2 weeks. |
| Agency for Toxic Substances and Disease Registry (ATSDR) | The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services. |
| Aquifer | An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs. |
| Chronic | A long period of time. A chronic exposure is one which lasts for a year or longer. |
| Comparison value | A concentration of a chemical in soil, air or water that, if exceeded, requires further evaluation as a contaminant of potential health concern. The terms comparison value and screening level are often used synonymously. |
| Contaminant | Any chemical that exists in the environment or living organisms that is not normally found there. |
| Dose | A dose is the amount of a substance that gets into the body through ingestion, skin absorption or inhalation. It is calculated per kilogram of body weight per day. |
| Exposure | Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short-term (acute) or long-term (chronic). |

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| Groundwater | Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes. |
| Hazardous substance | Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive. |
| Maximum Contaminant Level (MCL) | A drinking water regulation established by the federal Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards. |
| Media | Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants. |
| Model Toxics Control Act (MTCA) | The hazardous waste cleanup law for Washington State. |
| Monitoring wells | Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant. |
| No apparent public health hazard | Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard. |
| Organic | Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water. |

Parts per billion (ppb)/Parts per million (ppm)

Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.

Route of exposure

The way in which a person may contact a chemical substance that includes ingestion, skin contact and breathing.

Volatile organic compound (VOC)

An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

The Washington State Department of Health (DOH) has prepared this health consultation in response to a request from the Whatcom County Health and Human Services Department (Whatcom County Health) to review and comment on Whatcom County Public Works', *Draft Report, Phase II Hydrogeologic Investigation, Y-Road Landfills, Whatcom County, Washington*, dated December 2001.

The Y Road landfills, owned and formerly operated by Whatcom County, are located on two parcels within the Carpenter Creek drainage basin, northeast of the City of Bellingham (Figure 1). Carpenter Creek discharges to Lake Whatcom, the City of Bellingham's public water supply. Both landfills contain waste disposal areas covered with shallow soils. Five-acre rural residential properties that use private water supply wells as a drinking water source are located north, south, and west of the landfills. Surface water, including springs located near the landfills, may also be used as a drinking water source.^{1, 2}

DOH prepared its first health consultation for the Y Road landfills in early 1999 at the request of several Whatcom County residents.¹ These residents were concerned that people who use drinking water in the vicinity of the landfills or who obtain their drinking water from Lake Whatcom were being exposed to harmful levels of chemicals released from the landfills. Three additional health consultations were conducted by DOH from mid-1999 to mid-2001 in response to studies planned and conducted by Whatcom County at the landfills.^{2, 3, 4}

Discussion

The second phase of the Y-Road Landfill hydrogeologic investigation was conducted in the fall of 2001. Four major tasks were conducted during the investigation: a well survey; characterization of the vadose zone and shallow aquifer system; groundwater quality monitoring at nearby domestic wells; and surface water monitoring at Carpenter Creek. The following items summarize DOH's comments on Whatcom County's investigation findings:

1. **Section 1.0, Executive Summary, Paragraph 7, page 1** - The report indicates that "both landfills are bound by thick layers of gravelly sand in an upgradient position to the east, suggesting that the perched aquifers are recharged by infiltration of precipitation to the east of the landfills." DOH concurs that the shallow aquifer below the Y Road landfill properties appears to receive recharge from the east. However, significant recharge to the shallow aquifer is also occurring through infiltration of rainwater on the landfill property. The landfills are covered with relatively permeable soils and the nonwaste areas appear to be underlain by thick layer of gravelly sand similar to the unit observed to the east of the landfill property.

Recommendation - Infiltration of rainwater on the landfill properties should be included

as a recharge source to the shallow aquifer.

2. **Section 2.1, Report Organization** - It appears that the limitations of the investigation were described in Section 9 of the report. However, this information was not included in the copy received by DOH.

Recommendation - The limitations of the Phase II investigation should be added to the final Phase II report.

3. **Section 2.5, Conceptual Hydrogeologic Model Review** - A number of sources of recharge were identified for the Squalicum Lake Valley Aquifer, a deeper aquifer that is the primary drinking water source near the landfills. However, the shallow aquifer is not included in that list. Recent geologic literature suggests that small cracks and joints in fine grained glacial deposits such as the silt and clays found in the Bellingham Drift, which lies between the shallow and deeper aquifers, can result in significant vertical groundwater movement.⁵ As a result, the shallow aquifer may be a potential source of recharge to the deeper aquifer.

Recommendation - The upper aquifer should be included in the list of potential sources of recharge to the Squalicum Lake Valley Aquifer.

4. **Section 3.1, Door-to-Door Survey** - The report indicates that a survey form and cover letter from Whatcom County Health was mailed to all landowners within 2000 feet of the landfill in an attempt to identify nearby domestic wells. Nineteen of the 40 landowners responded. This is a good first attempt for identifying domestic wells. However, it should not be the only method used since a significant percentage of landowners did not respond.

Recommendation - Whatcom County Health should directly contact those landowners that did not respond to the survey to try to obtain domestic well information.

5. **Section 3.2, Section 4.1, and Section 5.1, Sampling Methods** - Sample preservation is necessary when analyzing for certain chemicals (e.g., volatile organic compounds, metals) to maintain sample integrity. However, there is no information provided in the report to suggest that this was done during the domestic well, surface water, or geoprobe sampling conducted during the Phase II investigation.

Recommendation - Sample preservation should be addressed in the report. If samples were not preserved, a discussion should be included in the data validation section of the report that addresses how this could affect the sample results.

6. **Section 5.2, Field Observations** - The report indicates that subsurface soil samples were collected in three foot sections with an SPT sampler. However, it is unknown whether the sampler was pushed or driven into disturbed or undisturbed soils. This type of

information is important for determining sample representativeness.

Recommendation - A section should be added to the report describing the geoprobe sampling techniques.

7. **Section 5.2, Field Observations** - Methane monitoring was conducted during the geoprobe work. However, no information is provided about the monitoring technique, frequency, or the results obtained at each geoprobe location.

Recommendation - The methane monitoring procedures and frequency should be described in the final Phase II report and the results reported on the geoprobe logs and plotted on site maps or cross sections.

8. **Section 5.2, Field Observations** - Some soil density descriptions were included on the geoprobe logs. However, DOH could not determine how soil density was determined since it appears that the samples were not driven with a weighted hammer.

Recommendation - Standard geotechnical methods exist for determining soil density. If these methods were not employed during the geoprobe investigation, density descriptions should be removed from the logs.

9. **Section 5.2, Field Observations** - The report indicates that geoprobe locations are approximate and that topographic information is based on general site observation (Y Road I) or environmental work conducted in the past (Y Road II). Without more detail about how geoprobes and topographic features were horizontally and vertically located, DOH cannot determine whether the maps and cross sections generated with this data (Figures 3 to 7) represent site conditions.

Recommendation - A discussion about how geoprobes and topographic features were horizontally and vertically located should be provided in the report.

10. **Section 5.2.1 Y Road I and Section 5.2.2 Y Road II** - No information is provided about the methane monitoring conducted at Y Road I. Only limited information is provided for the methane monitoring conducted at Y Road II

Recommendation - The methane monitoring results obtained at Y Road I and II should be summarized in the report.

11. **Section 6.1, Data Validation** - Problems with the matrix spike/matrix spike duplicate results obtained during the volatile organic compounds (VOCs) analysis for the Carpenter Creek surface water sample required that the sample be re-analyzed. However, the re-analysis was done outside the holding time which can result in reduced concentrations of VOCs. Although these problems suggest that the surface water results should be qualified, the report indicates that “comparison of the initial analysis and the

reanalysis revealed that no VOCs were detected in either analysis, so no further action was taken.”

Recommendation - The VOC data results for surface water should be qualified.

12. **Section 6.2.1, Domestic Water Supply Wells** - Arsenic, which ranged from 0.9 to 7.4 ug/l, was the only metal detected in the domestic wells that exceeded the ground water criteria used during the investigation. However, metals were not included in the discussion of the domestic water supply well results.

Recommendation - The arsenic and other metal results should be summarized in the report.

13. **Section 6.2.1, Domestic Water Supply Wells** - DOH compared chemicals detected in the domestic wells with conservative health based screening values. Arsenic (0.9 to 7.4 ug/l) was the only chemical that exceeded its screening value (cancer risk evaluation guideline of 0.02 ug/l) in the four tested wells. Because screening values are developed using conservative assumptions, DOH further evaluated arsenic levels using the new EPA maximum contaminant level (MCL) of 10 ug/l. The MCL for arsenic is intended to protect people against the effects of long-term chronic exposure to arsenic in drinking water. As a result, the elevated arsenic levels detected in the domestic wells do not appear to pose a health threat.

Recommendation: Whatcom County should consider using the arsenic MCL when evaluating potential human health risks associated with arsenic. Domestic well results should be provided to well owners and users. The need for further sampling of these wells should be evaluated based on future monitoring wells results. Those residential wells containing arsenic should be monitored to ensure that levels do not increase in the future.

14. **Section 6.2.2, Carpenter Creek** - The analytical results obtained from the Carpenter Creek surface water sample were compared to surface water criteria. Surface water criteria include values for ecological protection, human ingestion of aquatic organisms and surface water, and human ingestion of surface water only. However, there is no discussion in the report about which surface water values were used.

Recommendation - Since Carpenter Creek may contain edible aquatic species, is a possible drinking water source, and discharges to Lake Whatcom, the City of Bellingham’s drinking water source, the Environmental Protection Agency’s water quality criteria and other appropriate criteria that are protective of humans who ingest aquatic organism and surface water should be used as comparison values.

15. **Section 6.2.3, Focused Groundwater Investigation** - DOH compared chemicals detected in groundwater samples from geoprobes GP-13 and GP-14 located in the Y

Road I landfill to drinking water screening values because shallow groundwater is a potential drinking water source. Total arsenic, chromium, iron, lead, manganese, nickel, and zinc in GP-13 and total arsenic in GP-14 were the only chemicals that exceeded the screening values. Only total arsenic level in GP-13 exceeds the new EPA MCL. The dissolved concentrations of these same chemicals were below screening values. These findings suggest that suspended sediment in the unfiltered samples may have contributed to the elevated metal concentrations in groundwater below the landfill.

Recommendation - Future groundwater sampling should be conducted in properly designed monitoring wells using sampling techniques that reduce the suspended sediment levels in unfiltered samples.

16. **Section 7.1, New Subsurface Information** - In reviewing the geoprobe logs for Y Road II where no groundwater was encountered during the Phase II investigation, it appears that none of the borings likely encountered the top of the till unit where groundwater would likely be perched. Till is generally a low permeability soil that contains greater than 12 % (percent) silt and clay. Eight of the ten borings (GP-1, GP-2, and GP-4 through GP-10) were terminated in relatively clean sands and gravels (SP, GP, SM/SP, GM/GP); the remaining two borings (GP-3, GP-3B) were terminated in fill. DOH anticipates that groundwater would have been encountered if the geoprobes were drilled deeper.

A similar situation exists at Y Road I except till (ML, SM, GM) was encountered in some borings (GP-11, GP-13, GP-14). At these geoprobe locations, groundwater was encountered above the till unit. A number of borings were terminated in the relatively clean gravel and sand unit (GP-12, GP-16, GP-19) or fill (GP-15, GP-17, GP-18). No groundwater was encountered in these borings but, like Y Road II, may have been encountered if the geoprobes had been drilled deeper.

Recommendation - The report should be revised to reflect that groundwater may have not been encountered because the geoprobes were not drilled deep enough.

During future investigations at the site, borings should be installed to the base of the sand and gravel unit. A drill rig capable of drilling through the sand and gravel should be used rather than a geoprobe rig, which appears to have had significant problems penetrating the unit.

17. **Section 7.1, New Subsurface Information** - Based on a review of the surface water and groundwater analytical data for Y Road I, it appears that the Carpenter Creek surface water sample contained some of the same organic compounds as the nearby groundwater. This suggests that groundwater is discharging to the creek.

Recommendation - The above information should be included in the discussion about the connection between the groundwater and surface water systems.

18. **Section 7.2, Hydrogeologic Cross-Sections** - The cross sections suggest that many of the borings were drilled to the top or close to the top of the till unit.

Recommendation - The cross sections and the text should be revised to reflect that the contact between the sand and gravel unit and till unit is unknown.

19. **Section 8, Conclusions and Recommendations** - The report concludes that the surface water quality results obtained for Carpenter Creek during Phase II were consistent with the surface water samples results obtained during Phase I and recommends that no further surface water sampling be conducted. Considering that four samples were collected during Phase I versus one sample for Phase II, which was collected in a different location than any of the previous samples, does not support this conclusion. In addition, both rounds show leachate impacts from the landfills (see Section 2.4 of the report and Comment 17, above).

Recommendation- Surface water sampling at Carpenter Creek, and possibly Olsen Creek, should be conducted after the monitoring wells are installed at the landfill and groundwater flow direction and discharge patterns are better understood.

20. **Section 8, Conclusions and Recommendations** - Four groundwater monitoring wells are proposed to be installed at each landfill during the next phase of investigation. One upgradient and three downgradient wells are proposed for the Y Road I landfill. This is a typical, initial, monitoring well system configuration for evaluating whether a landfill or other contaminated site is affecting nearby groundwater quality. Three of the four monitoring wells proposed to be installed within the Y Road II landfill appear to be located within the waste boundaries. Although installing a well within the waste can provide some information about leachate quality useful for evaluating impacts on underlying aquifers, the rationale for installing three monitoring wells within the waste is unclear.

Recommendation - DOH recommends that Whatcom County re-evaluate its proposed monitoring well system design for the two landfills. One upgradient and three downgradient monitoring wells should be installed outside of the waste boundaries. A minimum of one leachate well should be installed within or at the base of the waste to characterize leachate quality.

21. **Section 8, Conclusions and Recommendations** - The report indicates that methane gas was encountered in four geoprobe borings at the Y-Road II landfill at concentrations ranging from 10 to 42% by volume, which exceeds the 5% by volume, or 100% of the lower explosive limit (LEL) allowed under Washington's *Minimal Functional Standards for Solid Waste Handling*. The levels of methane gas below Y Road I are unknown. Since these landfills are surrounded by a relatively permeable sand and gravel, methane and possibly other volatile organic compounds (VOCs) can readily travel toward nearby residential structures where it can pose a potential health threat.

Recommendation - Because of the potential health threat posed by the methane and possibly other VOC gases at Y Road II, Whatcom County should install and sample gas probes around the landfill boundary to ensure that landfill gases are not migrating into nearby residential structures at levels of health concern.

Child Health Initiative

The Y Road landfills are located in a rural, residential area where children potentially could be exposed to landfill contaminants through the groundwater, surface water, and indoor air pathways. Children can be uniquely vulnerable to the hazardous effects of environmental contaminants. When compared to adults, pound for pound of body weight, children drink more water, eat more food, and breathe more air. These facts lead to an increased exposure to contaminants in various environmental media. Additionally, the fetus is highly sensitive to many chemicals, particularly with respect to potential impacts on childhood development. For these reasons, it is very important to consider the specific impacts that contaminants may have on children, as well as other sensitive populations.

Conclusions

1. The chemicals detected in October 2001 in four domestic wells that are screened in the Squalicum Lake Valley Aquifer near the Y Road landfills pose no apparent public health hazard. Arsenic levels in these wells are below the new MCL set by EPA and so are considered to pose only a very low health risk.
2. Only limited information is available about the potential effects of the landfills on groundwater, surface water and soil gas. It is, therefore, unknown whether the Y Road landfills pose a public health hazard to other domestic wells and Lake Whatcom, the City of Bellingham's drinking water source or the indoor air at nearby residences.

Recommendations/Action Plan

1. Whatcom County should revise the Phase II hydrogeologic investigation report and proposed plans for future investigations based on the DOH recommendations provided in the Discussion section of this document.
2. Whatcom County should provide future project reports and plans to DOH for review.
3. DOH is available to assist the county with communication of the domestic well sampling results.

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1. Health Consultation, Y Road Landfill (1 of 2), Northeast of Bellingham, Whatcom County, Washington, Washington State Department of Health, March 13, 2000.
2. Health Consultation, Y Road Landfill (2 of 2), Northeast of Bellingham, Whatcom County, Washington, Washington State Department of Health, March 13, 2000.
3. Phase I Hydrogeologic Investigation, Y Road Landfills, Whatcom County, Washington, BEK Engineering & Environmental, June 26, 2000.
4. Scope of Work, Phase II Environmental Investigation, Y Road Landfills, Whatcom County, Washington, September 17, 2001.
5. Ohio Journal of Science, Fractures in Ohio's Glacial Till, Volume 100, Number 3/4, June/September 2000.

Certification

This Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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